

CLAIMS

- 1 1. A graph walking system, comprising:
 - 2 a binding system for binding a graph observer with a data graph, for binding node
 - 3 patterns to node observers to generate at least one node pattern/node observer pair, and for
 - 4 binding the data graph observer to at least one node pattern/node observer pairing, and wherein
 - 5 each node pattern includes a computed set of target sub-node patterns;
 - 6 a node relationship graph (NRG), wherein each node in the NRG corresponds to at least
 - 7 one node in the data graph, and wherein each node in the NRG includes a computed set of valid
 - 8 sub-node patterns;
 - 9 graph walking logic for systematically walking through nodes in the data graph and
 - 10 corresponding nodes in the NRG; and
 - 11 a pattern testing system that determines if the set of target sub-node patterns for a node
 - 12 pattern matches the set of valid sub-node patterns for a corresponding NRG node when a node is
 - 13 encountered in the data graph.
- 1 2. The graph walking system of claim 1, wherein the set of target sub-node patterns includes at
- 2 least one generational node pattern.
- 1 3. The graph walking system of claim 1, further comprising a graph observer pruning system for
- 2 deactivating a graph observer for sub-node processing when no matches occur between target
- 3 sub-node patterns and valid sub-node patterns for an encountered node.

1 4. The graph walking system of claim 3, wherein the graph walking logic includes a sub-node
2 pruning system for disabling the graph walking logic when all graph observers for a set of sub-
3 node have been deactivated.

1 5. The graph walking system of claim 1, wherein the graph walking logic stores a list of node
2 pattern/node observer pairs corresponding to matches made by the pattern testing system for
3 each node.

1 6. The graph walking system of claim 5, wherein, for a root node, the pattern testing system tests
2 each target sub-node pattern for all node patterns bound the graph observer, and adds a
3 corresponding node pattern/node observer pair to the list of corresponding node pattern/node
4 observer pairs for the root node.

1 7. The graph walking system of claim 5, wherein, for a child node, the pattern testing system
2 tests each target sub-node pattern associated with the list of node pattern/node observer pairs
3 stored for a parent node.

1 8. The graph walking system of claim 7, wherein the pattern testing system adds a
2 corresponding node pattern/node observer pair to the list of corresponding node pattern/node
3 observer pairs for the child node when a match occurs.

1 9. A system for optimizing a graph walking process of an inputted data graph based on inputted
2 node patterns and a node relationship graph (NRG) that corresponds to the inputted data graph,
3 the system comprising:

4 a system for generating a set of valid sub-node patterns for each node in the NRG;
5 a system for generating a set of target sub-node patterns for each inputted node pattern;
6 a graph processor for systematically walking through nodes within the data graph and
7 corresponding nodes in the NRG; and
8 a pattern testing system that determines if the target sub-node patterns for a node pattern
9 match the valid sub-node patterns for a corresponding node in the NRG when a node is
10 encountered in the data graph.

11 10. The system of claim 9, further comprising a first pruning system that can be instructed by a
12 node observer bound with an associated graph observer to deactivate the associated graph
13 observer for a set of sub-nodes when no matches occur between target sub-node patterns and
14 valid sub-node patterns.

1 11. The system of claim 10, further comprising a second pruning system that can instruct the
2 graph processor not to walk the set of sub-nodes if all graph observers have been deactivated.

1 12. The system of claim 9, wherein the graph processor includes a root node test, wherein the
2 root node test tests all target sub-node patterns.

1 13. The system of claim 9, wherein the graph processor includes a child node test, wherein the
2 child node test tests only target sub-node patterns associated with node patterns that had at least
3 one match in a parent node.

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1 14. A method for analyzing a graph of hierarchical data, comprising the steps of:
2 binding a plurality of graph observers to the graph, wherein each graph observer is
3 further bound to a set of inputted node patterns and a set of inputted node observers;
4 computing a set of target sub-node patterns for each inputted node pattern;
5 providing a node relationship graph (NRG) for the graph, wherein each node in the NRG
6 corresponds to a node in the graph;
7 computing a set of valid sub-node patterns for each node in the NRG;
8 systematically walking through nodes within the graph;
9 testing to determine if the target sub-node patterns for a node pattern matches the valid
10 sub-node patterns for a corresponding NRG node when a node is encountered in the graph; and
11 deactivating an identified graph observer for sub-nodes of an encountered node if none of
12 the target sub-node patterns associated with node patterns bound to the identified graph observer
13 match valid sub-node patterns.

1 15. The method of claim 14, comprising the further step of reactivating the identified graph
2 observer after the sub-nodes of the encountered node have been walked.

1 16. A program product stored on a recordable medium, which when executed, optimizes a graph
2 walking process of an inputted data graph based on inputted node patterns and a node
3 relationship graph (NRG) that corresponds to the inputted data graph, the program product
4 comprising:

5 means for generating a set of valid sub-node patterns for each node in the NRG;

6 means for generating a set of target sub-node patterns for each inputted node pattern;

7 means for systematically walking through nodes within the data graph and corresponding
8 nodes in the NRG; and

9 means for determining if the target sub-node patterns for a node pattern match the valid
10 sub-node patterns for a corresponding node in the NRG when a node is encountered in the data
11 graph.

12 17. The program product of claim 16, further comprising a first pruning system that can be
13 instructed by a node observer bound with an associated graph observer to deactivate the
14 associated graph observer for a set of sub-nodes when no matches occur between target sub-node
15 patterns and valid sub-node patterns.

1 18. The program product of claim 17, further comprising a second pruning system that can
2 instruct the graph processor not to walk the set of sub-nodes if all graph observers have been
3 deactivated.

1 19. The program product of claim 16, wherein the determining means includes a root node test,
2 wherein the root node test tests all target sub-node patterns.

1 20. The program product of claim 16, wherein the determining means includes a child node test,
2 wherein the child node test tests only target sub-node patterns associated with node patterns that
3 had at least one match in a parent node.

Patent for sale